[0056] Dynamics Of The Gyroscope

[0057] The dynamics of the idealized model for the gyro: understood in the noninertial coordinate frame associate previously stated, the system 10 is comprised of three ir masses 16, 18, and 20 where each mass can be assum a position vector attached to a rotating reference frame , acceleration in the inertial frame A

$$\vec{a_A} = \vec{a_B} + \dot{\vec{\Omega}} \times \vec{r_B} + \vec{\Omega} \times (\vec{\Omega} \times \vec{r_B}) + 2\vec{\Omega} \times \vec{v_B}$$

[0058]

[0059] where the subscript A denotes "relative to i denotes "relative to rotating gyroscope frame B," where and acceleration vectors with respect to the designated respectively, and where **Ω** is the angular velocity vector

[0096] In the drive mode, the gyroscope 10 is simply a 2-DOF sinusoidal drive force is applied to the first mass 16 (active mass) by drive structures 28. The combination of the second and the third ma: 20 comprise the vibration absorber 36 (passive mass) of the oscillat mechanically amplifies the oscillations of mass 16. Approximating th 10 by a lumped mass-spring-damper model as shown in Fig. 5(a), th of motion in the drive direction can be expressed as

[0097]

$$\begin{aligned} m_1\ddot{x}_1 + c_{1x}\dot{x}_1 + k_{1x}x_1 &= k_{2x}(x_2 - x_1) + F_d \\ (m_2 + m_3)\ddot{x}_2 + c_{2x}\dot{x}_2 + k_{2x}x_2 &= k_{2x}x_1. \end{aligned} \qquad (2)$$

[0098] When a constant-amplitude sinusoidal force $F_c = F_0$ sir applied on the active mass 16 by the interdigitated comb-drives 28, t state response of the system 12 as illustrated by graph Fig. 6(a) will in the equation,

sense-mode oscillator become

[00107]

$$m_2\ddot{y}_2 + c_{2y}\dot{y}_2 + k_{2y}y_2 = k_{3y}(y_3 - y_2) + 2m_2\Omega_z\dot{x}_2$$
$$m_3\ddot{y}_3 + c_{3y}\dot{y}_3 + k_{3y}y_3 = k_{3y}y_2 + 2m_3\Omega_z\dot{x}_2. \quad (3)$$

[00108] The response of the system to a constant-amplitude force is similar to that of the drive-mode oscillator as illustrated in t Fig. 6(b), with the resonant frequencies of the isolated active and p spring systems of $\omega_{2y} = (k_{2y}/m_2)^{1/2}$ and $\omega_{3y} = (k_{3y}/m_3)^{1/2}$ respectively frequency of the sinusoidal Coriolis force is matched with the resor of the isolated passive mass-spring system 40, the passive mass 2 maximum dynamic amplification.

[00109] The most important advantage of decoupling the driv and sense-mode oscillator 36 is that the Coriolis force that excites element 20 is not generated by the sensing element 20. Instead, F $2m_2\Omega_z dx_2/dt$ generated by mass 18 excites the active mass 16. Th the oscillator dictates that the passive mass 20 has to be minimize maximize its oscillation amplitude. Since the Coriolis Force F_{c3} = 2 generated by mass 20 is not required to be large, the sensing elen